

# METAL GATE WITH COMPOSITE FILM STACK

## Abstract

A novel metal gate structure includes a gate oxide layer formed on a surface of a silicon substrate, a doped silicon layer stacked on the gate oxide layer, a CVD ultra-thin titanium nitride film deposited on the doped silicon layer, a tungsten nitride layer stacked on the CVD ultra-thin titanium nitride film, a tungsten layer stacked on the tungsten nitride layer, and a nitride cap layer stacked on the tungsten layer. A liquid phase deposition (LPD) oxide spacer is formed on each sidewall of the metal gate stack. A silicon nitride spacer is formed on the LPD oxide spacer. The thickness of the CVD ultra-thin titanium nitride film is between 10 and 100 angstroms.